Clumping Modern Speleothems - Correcting for Variations Seen in Calcite $\Delta_{47}$ Precipitated Under Known Conditions

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Clumped isotopic measurements of CO$_2$ have great potential in measuring paleotemperatures recorded in rocks and sediment without knowledge of the initial isotopic composition of the water. However, applications to speleothems have proven to be complex and difficult, requiring better methods for processing and calibration in order to accurately interpret temperatures measured in the calcite. Monitoring experiments have been set up in a cave with modern forming stalagmites on the island of Eleuthera in the Bahamas. Glass plates (curved and flat) have been placed underneath dripping stalactites for periods of 4-5 months to precipitate calcite under known conditions. Ambient cave temperature, relative humidity, air chemistry, and drip water chemistry have been monitored since the start of the project in 2012. Although the temperature logger left in the cave has reported an average temperature of 23.5°C over the duration of the experiment, clumped isotope $\Delta_{47}$ values have reported temperatures consistently 10-15°C warmer. Our study of modern cave conditions allows for opportunities to experiment with methods of data correction/calibration in order to be able to better interpret clumped isotopic temperatures measured in ancient stalagmites. Plotting systematic offsets from expected values of $\Delta_{47}$ and $\delta^{18}$O measured in calcite samples from the modern cave gives a slope for disequilibrium. We are able to correct to the equilibrium line established by Tremaine et al., 2011 by using the disequilibrium slope from the modern. Although this correction does bring measured temperature values in the modern calcites close to the actual cave temperature, more work needs to be done to better this method for more universal application to all speleothems.